

What is Claimed is:

1. An apparatus for polishing a substrate comprised of an optical surface, wherein said apparatus is comprised of a polishing pad assembly comprised of a polishing pad, and means for oscillating said polishing pad, while simultaneously contacting said pad with at least 90 percent of said optical surface.
2. The apparatus as recited in claim 1, wherein said means for oscillating said polishing pad is comprised of means for moving said polishing pad in a non-linear motion.
3. The apparatus as recited in claim 2, further comprising moving said optical surface.
4. The apparatus as recited in claim 1, wherein said polishing pad assembly is comprised of a backing disposed within a tool body, wherein said tool body is comprised of a surface that is substantially congruent with said optical surface.
5. The apparatus as recited in claim 1, wherein said means for oscillating said polishing pad is comprised of means for moving said polishing pad in a linear motion.
6. The apparatus as recited in claim 1, further comprising means for rotating said polishing pad.
7. The apparatus as recited in claim 1, further comprising means for contacting said polishing pad with said optical surface, for maintaining a uniform pressure on said optical surface and across said optical surface, and for varying the amount of pressure applied by said polishing pad to said optical surface.

8. The apparatus as recited in claim 1, further comprising means for holding said substrate and allowing said substrate to rotate when it is contacted with said polishing pad.
9. The apparatus as recited in claim 1, further comprising means for holding said substrate and preventing said substrate from rotating when it is contacted with said polishing pad.
10. The apparatus as recited in claim 1, wherein said polishing pad is comprised of a bottom surface, and wherein said bottom surface is comprised of a multiplicity of recesses.
11. An apparatus for polishing a portion of an optical surface, wherein said apparatus is comprised of a polishing pad comprised of a surface that has a surface area that is less than about 0.15 times as great as the surface area of said optical surface, and means for oscillating said polishing pad.
12. The apparatus as recited in claim 11, further comprising a fixture for holding said polishing pad to said optical surface and for providing uniform pressure to said polishing surface.
13. The apparatus as recited in claim 12, further comprising means for varying the amount of said uniform pressure applied to said polishing surface.
14. The apparatus as recited in claim 11, comprising means of oscillating said polishing pad in a linear motion.

15. The apparatus as recited in claim 11, comprising means for oscillating pad in a non-linear motion.

16. The apparatus as recited in claim 11, further comprising means for rotating said optical surface while it is contiguous with said polishing pad.

17. The apparatus as recited in claim 11, further comprising means for holding said optical surface in a substantial tangential relationship with regard to said polishing pad.

18. The apparatus as recited in claim 11, further comprising means for subjecting said polishing pad to ultrasonic energy.

19. The apparatus as recited in claim 1, comprised of means for oscillating said polishing pad at a frequency of at least 250 hertz.

20. The apparatus as recited in claim 11, comprised of means for oscillating said polishing pad at a frequency of at least 250 hertz.